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To Mr. F.J. Kee
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HIGH FLASH RATE STROBE LIGHT STUDIES PICKERING GS. 1982

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The Pickering synchronized strobe light - rope net fish diversion system was modified to permit strobe light operation at 500 flashes per minute. Nine night replicates were conducted with the modified strobe lights illuminating the rope net barriers. Alewife passage through the experimental structure was reduced 36.2% relative to controls however this reduction was not statistically significant.

INTRODUCTION

A rope net - synchronized strobe light behavioural fish barrier was installed and tested at the Pickering GS fish diversion test facility in July 1982 (OHRD Report 83-405-K). Twenty - one tests were conducted with flash rates ranging from 60 to 453 flashes per minute (fpm). At these flashing rates the strobe light - rope net barrier was not effective in excluding alewife. Alewife passage was only reduced during three high flash rate (>400 fpm) experiments. Previous laboratory studies indicated that gizzard shad avoidance increased with increased strobe light flash rate (OHRD Report 79-104-K). It was therefore hypothesized that alewife avoidance of the rope - net synchronized strobe light barrier might be increased when the synchronized strobe lights operated at flash rates >450 fpm.

MATERIALS AND METHODS

The Pickering fish diversion test facilities (Figure 1) were used for the high flash rate synchronized strobe experiments. The facilities are described in OHRD Report 83-405-K . Electrical Research increased the maximum strobe unit flash rate from 453 fpm to 500 fpm. Higher flash rates were not feasible with the available strobe units.

job	file	date	report no.
740634-598-092	837.315	November 10, 1983	83-406-K

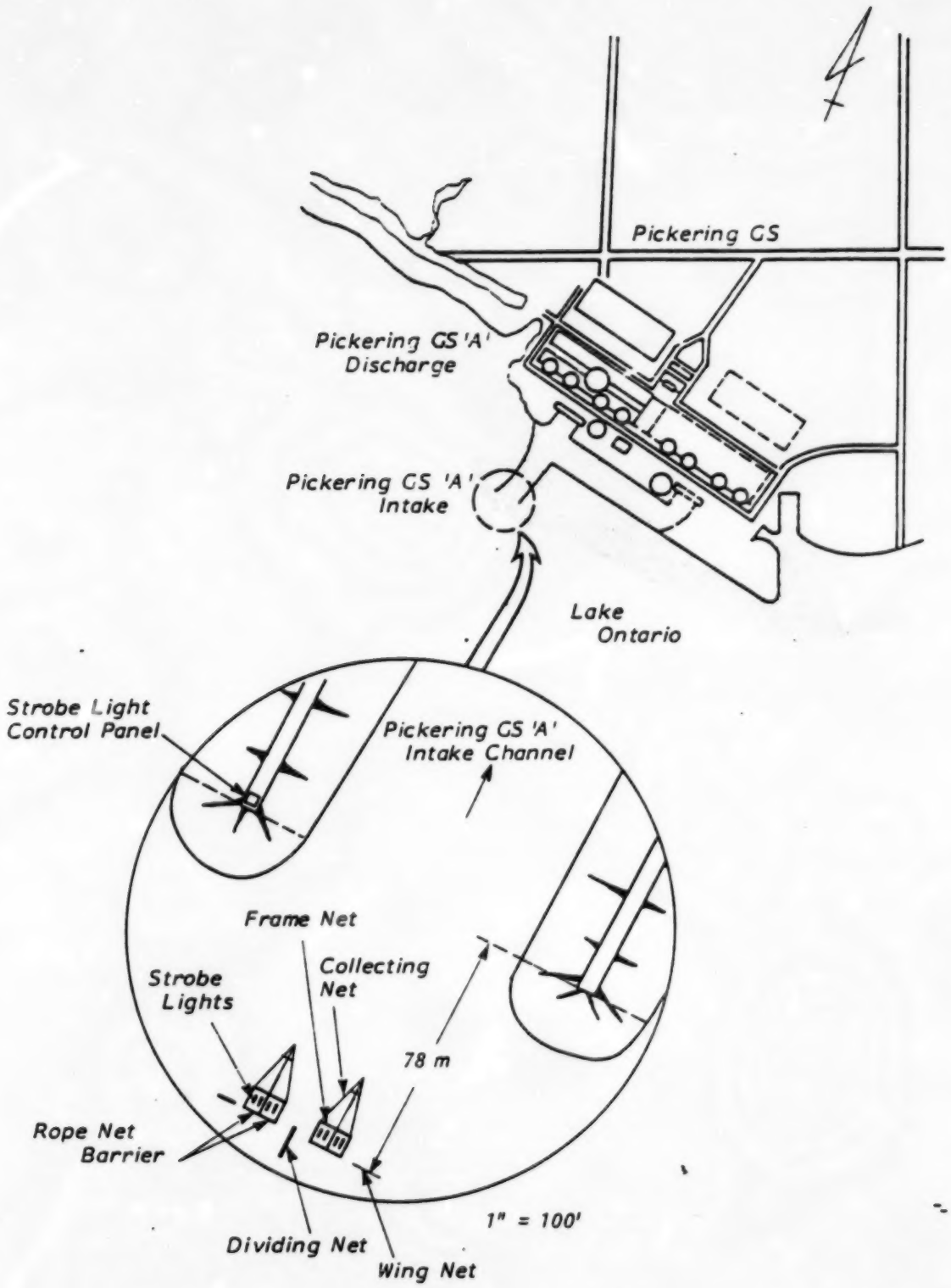

FIGURE 1

FISH DIVERSION SYSTEM STUDY LOCATION
PICKERING DIVERSION STUDY, 1982

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Nine 2 hour night test replicates were conducted following the same test procedures as described in OHRD Report 83-405-K (Appendix A). All experimental replicates were conducted at the west structure with alewife as the test species. Nylon 3.8 cm (1.5 in) gill net mesh selective for alewife was fished in the frame and wing net sets. All fish collected in the nets were speciated, enumerated and weighed. The direction of fish entry into the nets (from the lake or from the shore) was also recorded.

Water temperature and turbidity samples were obtained at the surface, 2.5 m and 5.0 m depths in front of each structure at test commencement. A malfunctioning light meter prevented the monitoring of light intensities at the rope net.

RESULTS

Nine 2 hour replicates were conducted September 13 - 17 (Appendix A). The frame net experimental CUE values (lake fish) were lower than the frame net control values (lake fish) on 6 of the 9 test occassions. The frame net control and experimental CUE values (lake fish) ranged from 0-17 ($\bar{x}$=6.4) and 0-11 ($\bar{x}$=4.1) respectively (Table 1). The differences between the frame net control and experimental values were not significant (two-tailed Wilcoxon matched pairs signed ranks test, P>0.05). The wing net control and experimental CUE values (lake fish) ranged from 3-15 ($\bar{x}$=9.1) and 8-30 ($\bar{x}$=18.3) respectively. Analysis of the wing net CUE data (lake fish) indicated no significant difference between CUE values (two-tailed Wilcoxon matched pairs signed ranks test, P>0.05). The wing net CUE values (shore fish) ranged from 3 - 19 ($\bar{x}$=8.0) in the control nets and from 6 - 35 ($\bar{x}$=13.3) in the experimental nets. The differences between the control and experimental wing net shore CUE values were not significant (two-tailed Wilcoxon matched pairs signed ranks test, P>0.05).

Water temperatures varied from 13.0-19.0 °C at each structure while turbidity values ranged from 1.1-3.3 NTU at the east structure (control) and from 1.0-4.3 NTU at the west (experimental) structure (Appendix B). The east and west structure water temperature and turbidity values were not significantly different (two-tailed Wilcoxon matched pairs signed rank test, P>0.05).

The number of operational strobes ranged from 8 (September 16, 2145 hr) to 9 (all other dates, Appendix B). Light intensities at the rope net during the replicates were not measured.

DISCUSSION

Previous field fish diversion studies indicated the use of the rope net barrier alone would significantly reduce alewife passage through the diversion structures at night (86% reduction, OHRD Report 83-405-K). However, alewife passage through the diversion structures was not reduced when the rope net was illuminated by synchronized strobe lights operating at <400 fpm (12.6% increase,

TABLE 1

SUMMARY ROPE NET = SYNCHRONIZED STROBE (500 FPM)
FISH CATCH RESULTS

	CONTROL		EXPERIMENTAL		EFFECTIVENESS
	FRAME (C) NET	WING NET	FRAME (E) NET	WING NET	C-E X 100 / C
TOTAL	58	82	37	165	36.2
MEAN	6.4	9.1	4.1	18.3	
RANGE	0-17	3-15	0-11	8-30	

not significant). The results of the present study indicated alewife passage through the rope net illuminated by synchronized strobe lights operating at 500 fpm was reduced (36.2% reduction). However this reduction is less than the reduction attained with the rope net alone and was not significant. The reason for the reduction in barrier efficiency when the strobe lights are used is not known. The experimental and control wing net CUE values do not indicate any significant alewife attraction to the experimental structure during the strobe light studies. Alewife may however have been attracted to the strobe light test area from the far field where the strobe light may appear to be a continuous light source.

Water temperature and turbidity values were similar at the control and experimental structures and probably did not influence frame net CUE values.

RECOMMENDATIONS

1) Further intake fish diversion studies with strobe lights illuminating a rope net barrier are not recommended.

Approved:

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RWS

REFERENCES

1. Ontario Hydro Research Division Report No. 79-104-K. "Responses of Gizzard Shad to Strobe Light", P.H. Patrick, March 26, 1979.

2. Ontario Hydro Research Division Report No. 83-405-K. Bruce GS 'B' Fish Diversion Test Program, Pickering GS, 1982. R.W. Sheehan

APPENDII A

ROPE NET - SYNCHRONIZED STROBE (500 FPM) FISH CATCH RESULTS
PICKERING STROBE STUDY, 1982

			Frame Net				Wing Net			
		Duration	Control		Test		Control		Test	
Date	Time	(Hrs)	L	S	L	S	L	S	L	S
September 13	2000-2200	2	0	4	0	7	15	8	12	7
	2220-0020	2	3	9	2	4	7	19	18	11
14	1930-2130	2	6	7	1	5	6	5	30	10
	2200-0000	2	0	4	2	9	3	5	27	22
15	2000-2200	2	9	12	4	15	5	9	22	7
	2215-0015	2	4	6	2	1	15	3	20	6
16	1930-2130	2	17	27	6	30	14	6	10	35
	2145-2345	2	6	11	11	28	4	4	8	19
17	2000-2200	2	13	6	9	39	13	13	18	15

L - fish entering nets from lake side

S - fish entering nets from shore side

APPENDIX B

WATER TEMPERATURE (°C) AND TURBIDITY (NTU) VALUES AND NUMBER OF OPERATIONAL STROBE UNITS PICKERING STROBE STUDY, 1982

Date	Time	Temperature						Turbidity						Number of Operational Strobes
		Control			Experimental			Control			Experimental			
		S	M	B	S	M	B	S	M	B	S	M	B	
September 13	2000	18.0	18.0	15.0	18.0	15.0	15.0	-	1.7	1.9	4.3	1.9	2.1	9
13	2200	18.0	15.5	15.0	18.0	15.0	15.0	2.7	2.5	2.0	2.0	1.9	3.2	9
14	1930	19.0	17.0	17.0	19.0	17.0	17.0	1.4	1.5	1.8	1.0	1.2	1.4	9
14	2200	19.0	17.0	17.0	19.0	17.0	17.0	1.2	1.3	1.4	1.2	1.6	1.6	9
15	2000	17.0	17.0	16.5	17.0	17.0	16.5	1.7	2.2	2.4	2.4	2.1	2.2	9
15	2215	17.0	15.0	15.0	17.0	15.0	15.0	1.1	1.2	1.2	1.0	1.1	1.3	9
16	1930	17.5	17.0	15.0	19.0	17.5	14.0	1.1	1.2	1.2	1.0	1.1	1.3	9
16	2145	18.5	17.0	15.0	19.0	17.5	14.0	3.3	2.4	2.5	2.2	2.0	2.4	8
17	2000	13.0	13.0	13.0	13.0	13.0	13.0	-	-	-	-	-	-	9

S - surface sample
M - mid depth sample
B - bottom sample